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ABSTRACT

This paper was designed to assist educators and employers as they plan curricula in language and communication skills for students and employees entering, or experiencing a transition to, automated work settings. The strategies presented in this paper may be adaptable to secondary school business skills and basic English courses, pre-employment training programs, and employee training and retraining departments within corporations and public agencies. The four sections of the paper discuss the following topics: the automating workplace and the knowledge worker; communication as a means of production in the information economy, including automation tools and techniques; the automated workplace: literacy in evolution; and literacy training for workplace automation. This last section includes information on training for functional competence, functional literacy skills, topics for functional literacy training, and training delivery models. A bibliography completes the paper. (KC)

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CHANGING CHANNELS: A GUIDE TO FUNCTIONAL LITERACY FOR THE AUTOMATED WORKPLACE

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PREFACE

Changing Channels: A Guide to Functional Literacy in the Automated Workplace is designed to assist educators and employers as they plan curricula in language and communication skills for students and employees entering, or experiencing a transition to, automated worksettings. The strategies presented here should be equally adaptable to secondary school business skills and basic English courses, pre-employment training programs, and employee training and retraining departments within corporations and public agencies.

While there has been a great deal of attention devoted to "computer literacy" and "technological literacy" in the training and educational development fields, relatively little has been offered that addresses the basic communication skills required for successful functioning in an automated workplace. Insufficient institutional attention has been devoted to the growing communication skills needs of those who find employment in many industries affected by, but not dedicated to, innovation in information processing. Yet automation affects -- indeed, is designed to alter -- the entire communicative structure of the workplace into which it is introduced.

All workers, whether working hands-on with automated tools or not, may find themselves in an environment in which information is of paramount importance and communication flows through new and unfamiliar channels. To be effective, employees must be able to select among and utilize all the communication channels available to them: face-to-face

interaction and group meetings; telephone; audio and video conferencing; memos, letters, reports, and other paper documents; electronic message and conferencing systems and electronic reproduction systems such as facsimile. While some workers require training in specific computer-based skills associated with their individual job, increasingly, success in all job categories is dependent upon comprehension of and ability to effectively manipulate the communicative structure of their organization.

Thus this guide explores the functions of literacy in the automated workplace, pointing out how verbal and written communication skills are evolving as new media for information processing become widely available in the workplace. The pages that follow first offer a brief overview of the changing nature of the workplace. The second section describes the expanding repertoire of communication activities conducted by information economy workers. And, following thereon, the third section explores the range of literacy skills that are needed in the automated workplace, both traditional, and indispensible, basic communication skills, and others that are new in form or application. The curriculum development needs of educators and on-the-job trainers are the subject of the final section, which provides a variety of suggestions for integrating automated workplace literacy skills into new and existing training programs.

The materials presented in this guide are part of the Literacy and Language Program's on-going, long-term investigations of the functions of literacy.[1] Included in this work have been two field studies of

1. For full reports on this work see Green, Reder, and Conklin 1985, and Reder and Green 1985a, 1985b, and forthcoming.

communication in automated workplaces, a mid-size high technology corporation and a large bureaucratic agency.[1] Future projects include working in cooperation with private sector employers to develop and coordinate training programs in the functional literacy skills required for the automated workplace for secondary business and language arts teachers.

1. This work is described in Conklin and Reder 1984, Literacy and Language Program 1984, Reder and Conklin 1984 and work in progress by those authors.

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THE AUTOMATING WORKPLACE AND THE KNOWLEDGE WORKER

> The major asset required by employers of high school graduates seeking upwardly mobile careers is the ability to learn and to adapt to changes in the workplace. The continual evolution of work functions will require that workers master new knowledge and new skills throughout their working lives. The ability to learn will be the essential hallmark of the successful employee. -- Panel on Secondary School Education for the Changing Workplace, National Academy of Sciences

Changes in the Workforce

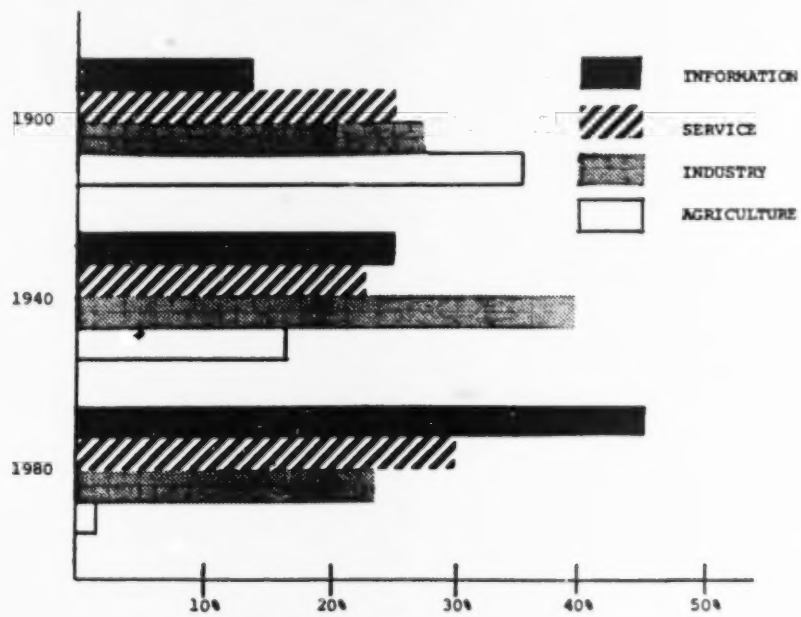
It is widely agreed that the U.S. economy is undergoing rapid change; some observers also foresee profound social changes following the spread of computer and information technologies throughout the American workplace. The key to success in the "information economy" -- for individuals and for companies -- appears to be education and training. And this education and training must be an ongoing process, not a one-time preparation. If, as some predict, by the end of the century specific job scope and job skills will be established anew every seven years (Strassmann 1985:216), then the capacity for continued learning and a positive attitude toward new learning must be the most valued assets in the "knowledge worker".

This term that was coined in the 1960s to describe the "knowledge industries" such as education, libraries, research institutes, and the media has come to characterize the general trend of economic expansion in the U.S. and the developed world. Those who are "knowledge workers" or "information workers" (after the "information sector" of the economy, in which they work) are coming to include not only professional and

managerial employees -- the traditional "paper shufflers" -- but a whole range of technical workers, from computer operators to foremen on the floors of automated plants; clericals and salespeople who work with state-of-the-art equipment; skilled laborers such as mechanics and machine operators for whom automated diagnosis has been developed; even workers in jobs previously characterized as low-skill, such as warehousemen. "Technological literacy" will be required of all of them.

The nation is in the process of transition from an economy whose most valuable product is goods to one whose wealth lies in information. Figure One demonstrates this dramatic trend. The information sector has grown during this century from employing less that 10% of the workforce to almost half of all workers by 1980. Many of those employed in the service sector are also engaged in information sector-related

FIGURE ONE: The Four Sectors of the U.S. Workforce by Percent, 1900, 1940, 1980



Source: Porat 1977.

dissemination and support tasks. According to the U.S. Department of Labor, by 1983 information workers made up 56% of the labor force. Included among these 54 million workers were 11 million executive and managerial employees, 16 million professionals and technicals, 11 million salespersons, and 16 million clericals.

Reflecting the expansion of the information sector, the fastest growing employment category is no longer clericals, but technicals/professionals. While technical/professional workers now constitute 16% of the total workforce, in 20 to 30 years they will be the largest sector of the labor force, accounting for approximately 24% of all workers (Strassmann 1985:197). Clericals will remain proportionally stable at the 15% of the workforce they have recently achieved; salespeople will increase from 11% to 15% of the workforce, with expansion of job skills into the area of ongoing consumer education (198).

Dramatic job losses are projected, suggesting not only the necessity of retraining current workers but perhaps redirecting secondary education and pre-employment training. The factory labor force will experience a 20- to 25% decline over the next decade due to automation (Office of Technology Assessment 1983:13). Additionally, 20 to 30 of the existing 50 million white collar workers will find their jobs affected by automation before 1990 and an additional 10 million white collar workers will face change of the nature or availability of work in the following decades (14-15). Clerical jobs, which have been a growth sector of the labor force in the early years of the transformation to the information economy, will no longer grow in actual numbers and will decline numerically by the end of the century. Some observers estimate a 30- to 50% reduction in the clerical workforce, especially in lower-skilled

positions (Williams 1983:210). The total number of viable positions in the workforce is expected to decline overall as automation takes hold in small as well as large firms, decreasing by perhaps five to 13 million positions (Fraser 1984:9).

One major study (Gutek, Bikson, and Mankin 1984) of 55 private sector firms found that 59% of managers foresee substantial changes in their workforce as result of automation, 36% reporting anticipated reductions among secretarials/clericals and, at the same time, 22% expecting to add professionals/technicals to their staffs (244). Furthermore, a majority of managers in those firms report that they have already or expect to change their performance standards in all job categories in the direction of requiring greater output. Table One details these managers' perceptions of changes in office tasks as a result of automation already in place. Almost no managers find that job skills have decreased (54% report higher skills; 44% the same skills before and after automation); the majority also see the variety of tasks performed by individual employees rising (54% report greater variety; 35% see job task variety equal). The greatest change is reported in job satisfaction, with 76% of managers judging that their employees are more satisfied in automated jobs.

TABLE ONE: Managers' Reports of Changes in Office Task Activities in 55 Private Sector Firms

Characteristic	Greater	Same	Less
Skill level	54%	44%	2%
Task variety	54%	35%	11%
Task feedback	38%	60%	2%
Place fluctuation	25%	56%	19%
Stress	24%	57%	19%
Satisfaction	76%	11%	13%

Source: Gutek, Bikson, & Mankin 1984:246.

These changes in the number, composition, and activities of the workforce will come about from widespread application of a variety of automation, information, and computer technologies. Robotization, computer-aided design (CAD), computer-aided manufacturing (CAM), and related technologies will affect the blue collar workforce most directly, bringing about a reduction of five to seven million jobs by the end of the century (Fraser 1983:9). Information and communication technologies will have their greatest impact on the white collar workforce, eliminating seven to 12 million jobs in the next 15 years (9). The remaining jobs, blue or white collar (and the distinction is disappearing), will be fundamentally altered by the new technologies.

Education and the Knowledge Worker

The model for the knowledge worker is drawn from occupations traditionally primarily concerned with information: physicians and engineers, appliers of knowledge; teachers, transmitters of knowledge; and managers, acquirers, storers and retrievers of knowledge (Williams 1983). These are all professionals who have maintained considerable decision-making authority over their own work. The expanding numbers of knowledge workers are also characterized as individuals who bear increasing responsiblity for scheduling, organizing, and carrying out their own work, self-motivated, and functioning with increasing autonomy for discretionary decision-making, rather than following a set of pre-determined options. Information technology tools are designed to assist workers in performing individual assessment of possible paths to work completion, as well as expediting the work itself. Although some workers will be deskilled, as, for example, secretaries placed into word

processing pools, observers believe automation will lead to higher demands on most workers remaining on the job:

> Designing organizations of the future cannot proceed on the assumption that this merely involves rearrangement of existing occupations and skills. Organizational design must recognize that information technology will totally transform traditional roles. Executives will be upgraded from investors to planners. Managers will be upgraded from coordinators to investors. Professional and technical personnel will be upgraded from specialists to generalists engaged in organizing the delivery of services to customers. Clerical personnel will be upgraded from support-staff members to specialists in the delivery of information services. Sales personnel will be upgraded from distributors of information to general managers of customer care and retention. (Strassman 1985:199)

Such radical changes in the nature of work entail the need for expanded, continuous worker education. Already public and private sector employers expend between $30 and $40 billion for training and education annually (Fraser 1983:2, Office of Technology Assessment 1983:33). Workers, too, are highly concerned about their employability and seek continued education: In 1981 13% of all Americans over 17 participated in adult education and 60% attended for job-related reasons (Office of Technology Assessment 1983:33). The largest proportion (30%) of those enrolled were professionals and technicals, the cutting edge of the information workforce (33). In that same year 11% of all employees in firms of 500 employees or more were participating in in-house training courses during their working hours (33).

Education will become the largest activity for the service sector in the knowledge-based economy, a necessary support to information work (Strassmann 1985:216). Projections for future training requirements state that, due to rapid job skill obsolescence, employers should budget 25% of their labor costs for professionals and technicals to education and training (198).

Just as, in public and private sector workplaces, the complexity of information and of decision-making increases with advancing technologies, so have educational development and delivery become more complex problems. It is not sufficient to train workers to work with a specific array of equipment or to perform a specific activity. Much information and communication technology is obsolete by the time it is mass-marketed; the next "generation" of hardware and software is waiting in the wings, faster, more flexible, more adaptable. And new equipment brings with it opportunity for revised operating procedures; employers must reconfigure their staffs to take full advantage.

It is not training for today's incidental situation that is required, but education that enables workers to adjust to, in fact to welcome, innovations in their work environment. Fast and accurate communication is the fundament of an economy in which information is the basic resource. Workers must be capable of maintaining high levels of functional literacy as the automated workplace evolves.

COMMUNICATION: THE MEANS OF PRODUCTION IN THE INFORMATION ECONOMY

> Knowledge, particularly theoretical knowledge, is the basic resource in this new economy . . . The manipulation and communication of information by professional and technical workers is the premium occupation in this type of society.
> -- Frederick Williams

The Information Economy

Information work already constitutes as much as 63% of all the work effort by the American labor force (Strassmann 1985:5-6). Not only professionals in high technology industries, but workers at all levels in all sectors of the economy are regularly engaged in information processing work. Just as growth in agricultural and industrial production was dependent upon development of distribution and marketing networks, the new product, information, is spawning a whole array of new distribution and marketing industries. Industries such as insurance, banking, finance, advertising and public relations, and publishing are clear examples of knowledge-based industry; one bank executive estimated that all banking work is three-quarters communication (Williams 1983:208). But industries such as travel, shipping, oil and chemicals, and utilities are also primarily information industries; the immediate accessibility of information via communications technology has radically transformed them. Public and private sector bureaucracies will continue to grow just to regulate and manage the new, intangible information product (Porat 1977).

Automation is reaching deeply into American offices; automation of manufacturing is following quickly. Computer-aided design and

manufacturing (CAD/CAM) tools are just coming into their own in American plants, however the impact of automation in office technology is already very apparent. Developed first for support of data processing activities, such as accounting and inventory control, since the 1960s computer and communication technologies have spread to workers in all categories. Table Two lists computing and communications skills needed for some positions in the 24 most numerous job categories for the current decade.

TABLE TWO: Jobs with the Greatest Numbers of Openings, 1978-90, and Information Technology Effects on Skill Requirements

Occupation	Annual Openings	Possible Applications of Advancing Technology
Secretaries/Stenographers	305,000	Using word processors
Retail Sales Workers	226,000	New products
Building Custodians	180,000	Using technology systems
Cashiers	119,000	Using computerized cash registers
Bookkeeping Workers	96,000	Using computer systems
Nursing Aides, Orderlies and Attendants	94,000	Observing monitors
Kindergarten and Elementary School Teachers	86,000	Using computer assisted instruction
Registered Nurses	85,000	Using new health care systems
Assemblers	77,000	Using automated systems
Waiters and Waitresses	70,000	Using computerized cash registers
Guards	70,000	Using telecommunications equipment
Blue-Collar Worker Supervisors	69,000	Using office computer
Accountants	61,000	Using computerized equipment
Licensed Practical Nurses	60,000	Keeping updated on skills
Typists	59,000	Using word processors
Carpenters	58,000	Using laser technology
Industrial Machine Repairers	58,000	Using computerized monitors
Real Estate Agents and Brokers	50,000	Using computerized listings
Construction Laborers	49,000	Understanding systems designs
Engineers	46,500	Designing computerized equipment
Bank Clerks	45,000	Using computerized data bases
Private Household Workers	45,000	Using home computers
Receptionists	41,000	Using telecommunications equipment
Wholesale Trade Sales Workers	40,000	Selling computerized equipment

Source: Crohn, 1983:12.

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The most obvious shift has been the past decade's transition from typewriting to word processing, automating clerical and secretarial jobs and, with their reduction and redistribution, the jobs of their (former) supervisors. Already 70% of U.S. companies rely on word processing to accomplish their daily tasks (Fraser 1984:6). Acceptance of automation by clericals has been strongly positive: Asked to rate their automated tools on a "love" vs. "hate" scale, 83% stated that they "love" their new equipment (13).

Even greater potential impact from office automation is expected in management's capabilities to control operations through direct access to more complete and up-to-date data (Olson and Lucas 1982:838). Management has already been profoundly affected by increased availability of computerized data bases. A study of 5,000 managers found that 49% already use a computer and that 78% of these computer users make daily use of their machine (Fraser 1984:2). Information formerly compiled and edited for management is now directly available to any user with a computer access line. Managers need not accept pre-digested analyses; they can view and manipulate all relevant data themselves. As organizational decision-making and information needs grow more complex these technologies become more and more indispensible. Yet greater accessibility of information can also lead to severe problems for decision-makers; they experience "information overload" and decreasing ability to discern which among a plethora of data are the significant factors to consider.

More generally, automation can and should bring about fundamental restructuring of organizations. With direct access to information

necessary to complete tasks, workers can function more autonomously. For example, in a sales department:

> The industrial model of office organization is based on a deliberate endeavor to maximize efficiency and output. To create an assembly line the flow of work must be analyzed, discrete tasks must be isolated, and work must be measured in some way. There is a need for standardization of jobs, transactions, technolgies, and even personal interactions. A fragmentation of responsibility goes hand in hand with bureaucratic organization and the proliferation of paperwork. Most of the workers have little sense of the overall task to which they are contributing their work, or of how the system functions as a whole. . . .
>
> In the information-age office, the machine is paced to the needs and abilities of the person who works with it. Instead of executing a small number of steps repetitively for a large number of accounts, one individual handles all customer-related activities for a much smaller number of accounts. Each worker has a terminal linked to a computer that maintains a data base of all customer-related records, which are updated as information is entered into the system. The worker becomes an account manager, works directly with the customer, and is fully acountable to the customer. (Giuliano 1985:305-06)

This model of task- or project-based work will require vastly different skills, especially skills in communication of information and in interpersonal communication.

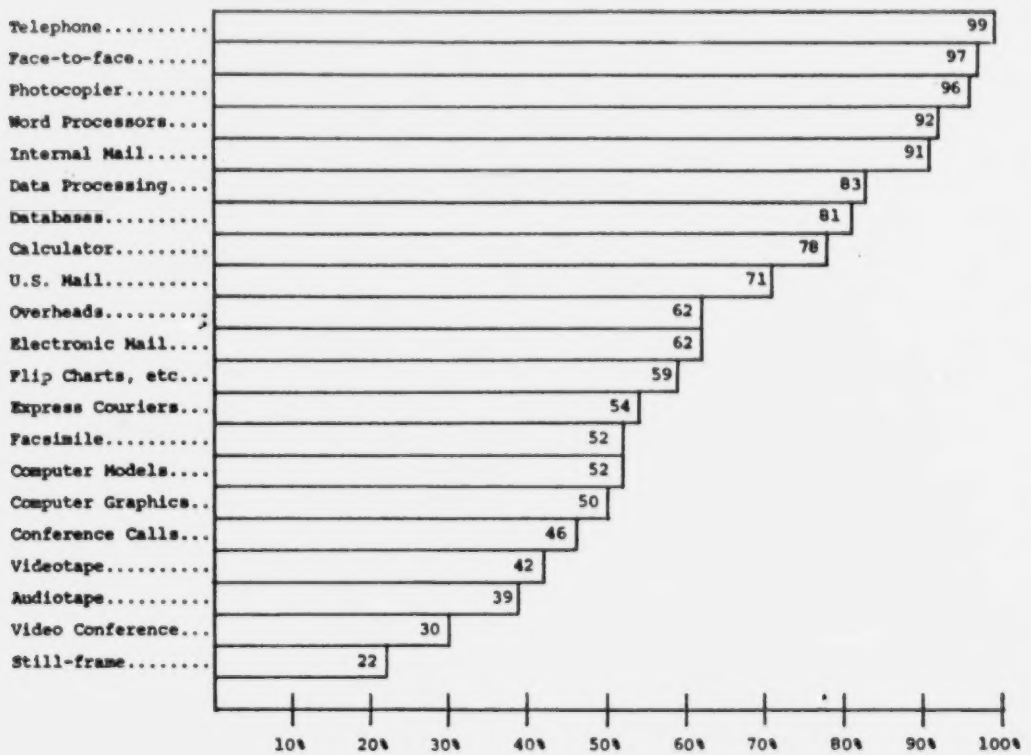
Automation Tools and Techniques

The attraction of automated office tools derives from the expansion of the information sector of the economy and also from the need to make information work more efficient. In the 1970s office productivity increased only four percent, while costs of office work doubled (Olson and Lucas 1982:838). As expenditure on labor continues to increase as a proportion of the costs of doing business, employers large and small look to automation to assist them. For example, the shift from creating a letter through a series of typewritten drafts to word processing reduces

the clerical costs from seven to two dollars. Then, if the letter can be sent electronically, rather than in paper form, the costs are reduced further to just thirty cents (Giuliano 1985:309).

A wide array of automation tools is already in place in American offices and factories, some used by only a segment of the workforce, others potentially utilized by employees in all job categories. In many companies automation first takes hold for routine in-office support work, but its obvious advantages lead to more extended communication technology applications, as in the above example of letter production cost savings. Figure Two details the penetration of technological tools into the work of professionals. Among tools deemed important or very important in

FIGURE TWO: Professionals' Use of Technological Tools



Source: Johansen and Charles 1984:19.

their work, the telephone and face-to-face interaction remain the first and second choices for communication, but a variety of devices (e.g., photocopiers, word processors, electronic data processors, and data base managers) are regularly brought to bear as support systems for professionals' work. The uses of the tools listed in Figure Two and yet newer technologies can best be understood in terms of the tasks they are designed to facilitate.

Data Processing. The "information revolution" began with computerized data processing equipment, automating the work of accounting, inventory, and other departments whose work involved manipulation of large data sets, especially data appearing in numeric form. Advances in data processing continue, integrating multi-step tasks into complex, fully automated processes.

The now ubiquitous electronic calculators are small versions of this data processing equipment. They are often "programmable", i.e., can be pre-set to follow a series of steps once numbers are entered. Data processing can now often be accomplished using personal or micro-computers; powerful data base management, accounting, finance , planning, and statistical programs are available for individual use. In many cases work previously performed by finance department personnel can now be conducted by the department's secretary using a pre-programmed budgetting and planning package.

Document Handling. Automation took hold for office workers in all departments with the introduction of electronically-assisted document handling tools. Photocopy machines can reproduce documents in full or altered size and in a variety of formats. Word processing (and text editing, as it is known for larger and more complex documents) has truly

transformed the way offices function. Because a word processing program can access and alter any section of a text, revisions are fast, easy, and are often accomplished not by a clerical, but by the professional or manager who is the document's author. Documents composed on word processors may be converted into paper text only at the final stage before distribution or may even be distributed electronically. Electronic facsimiles of documents, including not only text but reproductions of graphics, can be instantaneously forwarded to co-workers throughout the world.

File systems, too, are coming "on-line", i.e., stored electronically and retrievable from any computer access station in the company's network. Electronic files can, if need be, be printed in paper form, but are generally viewed on video screens. Essentially the computer serves as a central location for the files which can simultaneously be read and updated by any employee from his/her computer access station. Employees also keep their confidential and in-process work files on the computer where they are protected from general access by passwords.

Message Systems. Such electronic files form a substantial portion of the information communicated among employees via electronic message systems (EMS, also known as computer-based messaging and as electronic mail or e-mail). Electronic message systems permit workers to communicate not only with the machine, but to use it to directly communicate with other workers on the computer system. Short messages, memos, letters, and file material can be sent instantaneously to anyone who has a computer access station. The addressee receives notice of a message's arrival and may choose to respond immediately, setting up a dialog with the sender (synchronous communication), or may hold messages

until some point of greater convenience (asynchronous communication). In many companies electronic mail has replaced the inter-office paper mail system for most purposes.

Most e-mail systems permit access over telephone lines as well as from computer access stations at the company. Thus any employee with a personal computer, on or off the job, can obtain messages and contact fellow workers. Using electronic messaging employees can work from home or from field offices, sending messages to co-workers, receiving responses, and shipping information from general or personal files back and forth. And, using very small, portable computers business travelers can write reports in transit which are communicated to the home office via telephone connection.

Electronic mail can also be sent to persons in remote places and in other companies by use of networks, systems linking tens of thousands of users via computers dedicated to communicative functions. Use of electronic message systems in one of the fastest growing office automation technologies: Between 1981 and 1984 the number of "electronic mailboxes", i.e., the number of individual computer access stations linked to local or large-scale electronic message networks, grew nationally from 472,000 to 1,662,000 (Love and Rice 1985:2).

Electronic message systems also support electronic bulletin boards, special "mailboxes" listing information and requests for information to which any reader on the network can add or respond. Bulletin boards have proliferated for technical uses, e.g., exchanging research findings among scientists, and for an infinite variety of personal interests. Already certain technical publications are available through electronic message systems before, or in place of, printed editions.

Voice-based message systems (often known as voice store and forward (VS&F)) operate in a fashion parallel to electronic mail. Voice messaging systems require only a telephone which is linked to a computer programmed to interpret human speech and store it for transmission to the addressee. The message may then be read in electronically printed form or electronically reproduced as synthesized voice and listened to over another telephone by the recipient. Like e-mail, voice messaging has the advantage of instantaneous or delayed delivery, depending on the availability of the recipient. Both these systems eliminate "telephone tag" and permit workers to prioritize their responses to messages according to their urgency and their own work tasks. Voice messaging has been widely accepted by managerial workers who lack keyboarding skills necessary for electronic messaging. Cellular telephones make voice messaging even more widely accessible to business travelers.

Conferencing. Audio, video, and computer conferencing have begun to augment or replace face-to-face meetings in many workplaces. Most commercial telephone installations permit conference calling; many multi-site companies have installed video rooms in which groups at different plants can "meet". New technologies to support remote conferencing are appearing constantly, for example, electronic writing boards that permit remote sites to share a blackboard, each instantly receiving additions written on the board at the other site, so that the dynamics of the conference interaction are directly shared.

Computer or electronic conferencing became widely used in the 1970s and is increasingly a regular part of business practice in large firms. Computer conferencing is in many ways parallel to electronic messaging, but provides for interaction among a larger group of participants. It is

extensively used when groups of workers in several different locations are working jointly on a task. Each group member can enter text into the conference's common file for all to read. Often these are comments on things other participants have asserted or reported. Electronic data files are often submitted and draft documents are "circulated" to co-workers for comments. In many cases conferees may work together for months or even years without meeting face-to-face.

The automated workplace, then, depends heavily upon computer-mediated communication technologies. Electronic files and bulletin boards store information that is remotely and instantaneously retrievable. Electronic message systems and computer conferences have supplanted many paper, telephone, and face-to-face communications. Given their speed, convenience, and multiple accessibility, these technologies will become increasingly important and widespread.

Communication as Work

For the knowledge worker communication is a primary work activity and communicative effectiveness a measure of success. Time dedicated to communication activity will continue to increase as the information economy grows. A decade ago a pioneering study of chief executives found that 40% of such workers' time was devoted to receipt and dissemination of information (Mintzberg 1973:31-32). Many more hours were devoted to a variety of communication activities, such as negotiation about decisions, action and status requests, and ceremonial activities, amounting to 95% of executives' work efforts. Executives averaged per day 36 written contacts and 16 verbal contacts (8 in scheduled meetings, 5 phone calls, and 3 unscheduled interactions).

Several recent studies indicate that communication work is increasing as a proportion of employee effort. A survey at Xerox Corporation reports that managers and professionals spend 40% of their work time in writing tasks, over 20% on reading tasks, over 15% in meetings, and over 5% on the telephone -- a total of 80% of their labor (International Data Corporation 1981). A 1982 analysis of professionals' and managers' time found that 46% of their workday was spent in meetings (80% face-to-face and 20% on the phone) and an additional 21% of their time was devoted to document-related activities (Poppel 1982:148-49). Based on this study, it was projected that automation of these managers' and professionals' jobs would result in a 15% time savings within five years of implementation (149).

Further, a 1984 study of the full range of office workers -- clericals and technicals as well as managers and professionals -- in a partially automated firm found that employees, across the board, spent almost three-fourths of their time communicating: 9.8 hours weekly in face-to-face interaction, 7.5 hours reading and writing documents for correspondence, 5.6 hours on the telephone, 5.4 hours in scheduled meetings, and 1.5 hours using electronic mail (Conklin and Reder 1984:64).

These findings indicate that, as automation spreads throughout the office and from the office to the factory, communication skills will become increasingly critical for all employees. New job seekers and workers retraining for automation must acquire not merely adequate communication skills, but an understanding of how communication is evolving in the automated workplace.

THE AUTOMATED WORKPLACE: LITERACY IN EVOLUTION

> The development of computer literacy is much less likely to deemphasize written literacy than to make it more important than ever. The extent to which written literacy is already economically and socially stratified will strongly influence the distribution of computer literacy as well.
> -- Carolyn Marvin and Mark Winther

A New Literacy Channel

The past hundred years have witnessed a revolution in communication. Our choices among communication channels have expanded more rapidly than at any time in the past. Until introduction of the telephone, communication over distance could be accomplished only through the written medium. Indeed, dissemination of information to remote parties, together with the archiving of information, has been the function of literacy, with dissemination increasing in scope when the introduction of the printing press made it possible to reach a mass audience.

Oral channels (face-to-face, the telephone, and, in some recent business applications, audio and video conferencing) have been used for two-way communication. Through oral conversations and meetings ideas and information are exchanged, rather than disseminated, since all parties receive the speech simultaneously and have equal and immediate opportunity to respond. Writing, on the other hand, has been a medium for delayed response, rather than interaction.

Telegraphy, the first modern communication technology to be developed, increased the speed with which written messages could be received, but still did not provide an interactive medium for literacy.

With the advent of computer-mediated communication, literacy has finally become a channel with synchronous, or dialog, capabilities. That is, users of electronic messaging and conferencing systems can send written material back and forth instantaneously. Thus literacy has entered a new era: Writing is no longer a channel restricted to one-way communication. Electronic messaging and conferencing can function interactively, serving a group of participants as would the exchange in a face-to-face conversation or a telephone call. Interactive literacy will require adjustments in our understanding of the technical skills for writing, the range of writing's functions, and the social values attributed to the written word.

The new electronic literacy channel retains the traditional advantages of print: 1) messages can be distributed simultaneously in multiple copies ("copied" to co-workers in the next office or overseas and to the file system) and 2) they can be read upon receipt or stored (as electronic files or reprinted onto paper) for later response. Further, as a written medium electronic messages can be easily scanned, unlike oral messages which are difficult to work with except linearly, from beginning through to end. Electronic messages are headed by captions that list, for example, the sender, the topic, the level of urgency. Thus recipients can quickly sort through their e-mail, selecting some messages to read and respond to and others to set aside for a more convenient time. Selected portions of individual messages can be viewed and, if desired, turned into paper copies for detailed study.

Electronically-mediated literacy is, then, a new type of communication channel, combining advantages of both written and oral communication: It can be synchronous (like speech) or asynchronous (like

traditional print), allowing immediate two-way interaction or delayed response, and it (like print) is multiply, spacially distributable and offers a scannable text. The channel's flexibility offers a wide range of applications for workplace communication. However, these possiblities can only be fully exploited if workers possess both a commensurate range of writing and reading skills and the ability to assess when the new channel should be put to use.

The Knowledge and Practice of Literacy

Many hours of school time are devoted to literacy skills. Educational curriculua are structured to introduce the use of writing tools (in the early grades pencils; later pens, typewriters, and, recently, word processors), various genres of writing (first short fictional stories; later longer fiction, nonfiction, and poetry; in the secondary school critical and informational essays, as well as increasingly more complex technical materials), and a wide range of purposes for reading and writing (at first for amusement and classroom work; soon correspondence with friends and family; later comprehending and expressing abstract ideas and accomplishing necessary life tasks such as applying for a job, keeping records for one's employer, and paying one's taxes). Not just the technical skills for literacy are taught, but the functions literacy can play in our lives and how it is valued by society.

Training for the new literacy channel should proceed in the same way, describing not just how to use it, but for what, when, and why. Yet most training for workplace automation stops at the level of technical skill. A training course for electronic messaging and conferencing may provide instruction in keyboarding, if that is needed, and a brief overview of

the command structure of the message facilities. There is little consideration of the functions literacy plays in the workplace and how they will change with availability of the new channels. Frequently there is considerable anxiety about the new equipment. This, too, is handled in training as though it derived from lack of technical skills needed for the electronic medium. Yet the technical skills for electronic communication are very low level -- keyboard usage, but that can be "two finger typing", and just a handful of simple, menu-driven commands. Most workers are already performing far more complex tasks than the electronic message system will require.

Rather, difficulties in adjusting to automated communication lie more in workers' uncertainty about the functions of this channel in relation to existing communication conventions and, for workers previously unfamiliar with computers, the mystique that surrounds the machine. Training for communication using automated tools should address both the purposes for which the new channel is appropriate and take into account varying attitudes toward computers, specifically as they are to be used as an alternative medium for interpersonal interaction.

In research into adult illiteracy and training development for literacy acquisition among adults each of these three aspects of literacy practice -- the technical skills for reading and writing; the range of functions literacy does and might play in adults' daily lives; and their attitudes about literacy and illiteracy -- has proven equally critical (see, e.g., Green, Reder, and Conklin 1985; Heath 1980; Reder and Green 1985a, 1985b, and forthcoming; Szwed 1981). These insights can be fruitfully applied to the evolution of literacy in the automated workplace.

Technical skills. In the past 15 years debate has raged in educational and technical circles about the extent to which students and workers who should be trained for work with the computer, some arguing that computer programming should be added to the list of basic skills (e.g., Luehrmann 1972), others that an often ill-defined "familiarity" with the computer will be sufficient for most (e.g., Anderson, Klassen, and Johnson 1981). A recent far-ranging assessment of worker training needs for the U.S. Congress found that, while programming ability may not be necessary for most workers in the information economy, skills to work directly with computers will be:

> . . . in order to function as citizens in an information-based society that is driven in part by technological innovation, individuals must have knowledge of the computer as a tool for managing and providing access to massive amounts of information. This need to understand the applications of computer technology has resulted in a modified definition of basic literacy that includes familiarity with the computer. "Technological literacy" is now a common term used to describe a level of understanding of technology in its various forms that goes beyond a familiarity with the computer. Experts suggest that technological literacy will soon be required of all members of the workforce, as broader and more extensive applications of information technology are made in offices and plants. (Office of Technology Assessment 1983:36)

The Office of Technology Assessment (OTA) stresses widespread use of the computer as an information managing tool; much of this work will be interactive communication, passing information through the computer to other users via the literacy channels of electronic messaging and conferencing.

Certainly traditional reading and writing skills will remain crucially important. For many workers, literacy activities will increase, as they shift to directing use of computerized tools, rather than manually performing their jobs. Some of the specific technical skills in

writing and reading may shift, however. In writing, there is a trend away from handwriting and toward keyboarding. Many primary schools are experimenting with promising early writing programs in which children are introduced to literacy using a computer; their attention can be directed first to comprehension and composition skills, saving the actual manual training for handwriting until their physical coordination grows greater with age.

Reading and writing skills are perhaps growing more complex. The video screen requires different techniques from the printed page, in some ways presenting a more and in some a less flexible format. Scanning, for example, is very simple with a book or report; flipping through a printed document for its contents, its bibliography, for headlines, primary ideas, etc. is a typical study skill needed for using any printed reference material. Electronic text must be accessed differently, and, because of this, often new users rely extensively on printed duplicates of the electronic file. On the other hand, for writing, the electronic medium is far more open-ended, accessible at any point in the text for additions, infinitely rearrangable, and very easily corrected. Workers encountering automation must acquire facility in these new techniques.

Electronic communication may also alter the relationship of reading and writing:

> In the near term, we might profitably think about computer skills as additional proficiencies in the bundle we call literacy. Note that I have referred to computer skills as additional to, not replacements for, existing skills. Reading and writing will continue to be essential; computer memory may replace some paper and file drawers; but we will still have to compose sentences for a documentary format. And, although the text may appear on the screen, it must still be read and, of course, understood. Slightly further out, however, writing -- meaning composing with pen in hand or fingers on the keyboard -- may become less necessary. Although still far from perfected, work on voice

> recognition by computers is proceeding rapidly. Today, an increasing number of busy people dictate their letters, memos, and even books onto audio tape for later transcription by someone else. Ironically, this harks back to the Medieval era, when the educated composed orally to scribes who made the written record. With reliable voice recognition computers, we could return to such an era of oral literacy. (Compaine 1983:139)

Some of these non-keyboarding technologies have already proven attractive to managers, many of whom lack keyboarding skills. Voice messaging is coming into use, but also video screens for viewing text which can be commanded using a "mouse" (hand-rolled controller), small ten-key pads, or by touching the screen.

Reading will continue to expand, on paper as well as on video display units. It is estimated that the number of high speed printers in American offices will grow from 250,000 to 420,000 by 1990 and that paper consumption by professional and technical workers will triple to an average of 24,000 sheets per year by 1992 (Strassmann 1985:167). Since comprehension is twice to five times as fast through reading as through listening, voice messaging will not be an alternative to literacy for most business purposes in the information economy. Further, there appear to be some conceptual restrictions to composition in oral channels as well; studies of dictated memos and letters have shown that they are longer and less efficient than the same workers' hand-drafted texts (Burns 1980:230).

Functions. Far more complex, and unique to every workplace, will be the functions that the new literacy channel fulfills. In some organizations, especially those that are bureaucratic in nature, central decision-makers decide what automation tools will be put in place and how they will be used. As in conventional literacy, it is important for electronic correspondents to know the ways in which their community of colleagues expects to receive and send messages. There are situations in

which any channel except face-to-face would probably be inappropriate, for example, employee performance reviews. This is a highly delicate matter, requiring that both parties have the advantage of privacy; have access to the interpretational cues, nonverbal and in tone of delivery, that accompany speech; and have ample opportunity to provide immediate feedback and to correct any erroneous interpretations of written and spoken remarks. At the other extreme, a development proposal or specification report would rarely be submitted verbally, if the recipients are to expected to respond to the details it outlines.

In the range of information dissemination and communication tasks there is much room for individual decision-making about which channel to select. Some managers, departments, or firms may place high priority on frequent face-to-face interaction, supervisors and supervisees holding weekly staff meetings or "one-on-ones". In other firms communication tends more to be print-based, with memos flowing back and forth for formal and informal purposes. Electronic mail may be used to supplant or augment either oral or written communication, depending on the existing norms for choice of channel and the preferences of the workers as they become familiar with the facilities in electronic messaging systems.

Innovation in communication channel can be uniform throughout the company or left to the creativity and propensity of individuals. In a large public agency presently under study by these researchers, for example, central directives have defined the required uses for electronic files and electronic messages. This agency has traditionally relied heavily on paper for communication within its central office and to and among the many branch offices. The electronic message system replicates the traditional print information flow structure. Memos are still copied

to the same personnel; file systems are identically organized; signatures are required for official memoranda -- but all of these are performed via electronic channels. Communication flows in the same routes, but it flows more swiftly and can be responded to more readily. The implementation of the electronic communication system began at the top managerial level; employees thus were motivated to switch immediately to the new channel, in order to secure their supervisor's attention to routine, as well as urgent matters.

In a mid-sized corporation (reported in Conklin and Reder 1984), on the other hand, automation has proceeded through departmental initiative. Different divisions of the company have developed local practices for the use of electronic literacy, some managers requiring all reporting via electronic message, others using their system only for a few tasks like announcements and scheduling. For employees who rely heavily upon electronic messaging, the telephone and paper mail are regarded as nuisances. Many report that they give higher priority to messages that come to them via e-mail; some decline ever to take a phone call directly. Thus non-e-mail users never receive immediate turn-around on their requests, altering the utility of the telephone from an interactive to a delayed-response channel. These same workers, meanwhile, frequently respond to incoming electronic messages as they arrive, working interactively through that literacy channel.

While in the first example, the public agency, the functions of the communication channels are fairly well defined, in the second case there are no company-wide standards for communication channel choice. Workers in other departments and new workers must learn the communicative preferences of each of the fellow employees with whom they must conduct

business. Functional understanding of changing literacy practices requires not only that workers are informed -- via training or the grapevine -- about how to conduct their communicative business with the various branches of their firm, but because automation is constantly evolving, they must have the skills to recognize for themselves how to best use the communication channels at their disposal. The changing workplace requires workers who are analytic about the communicative structure in which they find themselves and able to make appropriate channel choices in varying situations.

Social meaning. Such analysis of communication depends upon workers' comprehension of the social meaning of literacy in their community of correspondents. What, for example, are the connotations attached to a formal, paper memo in a new worker's department? Perhaps the former place of work used memos only rarely, for official actions. For this worker a piece of paper, then, would be attributed too much import, if received in a department in which paper memos are routine for information dissemination. A manager who rarely calls staff meetings can be perceived as non-responsive by employees whose former supervisor used staff meetings as his/her means for information dissemination and maintenance of departmental cohesion. Such workers might overlook the fact that the new supervisor stops them far more regularly to discuss their progress informally or rountinely sends them announcements of official and unofficial interest via electronic mail.

Social meaning is attached to all communication channels and, when these connotations are not shared, is a major stumbling block to communication. Research on intercultural communication has shown that, while speakers may share knowledge of a common language, lack of

correspondence in the values placed on different ways of speaking can lead to misperception of a speaker's intent and misunderstanding of the message.

> Knowledge of contextualization . . . conventions reflect[s] prolonged interactive experience by individuals cooperating in institutionalized settings in the pursuit of shared goals in friendship, occupational or simlar networks of relationships. Once established, such conventionns come to serve as communicative resources which, by channelling interferences along certain lines, facilitate communication and enable individuals to build on shared understandings which eliminate the need for lengthy explanations. Knowledge of how such conventions work often becomes a precondition for effective participation in longer verbal encounters and for enlisting others' cooperation in activities at home, at work and in public affairs. (Gumperz 1982:209)

Skilled managers are sensitive to social meanings of communication channels. They weigh the pros and cons of addressing their supervisor or supervisees via formal memo, informal note, electronic mail, or face-to-face. They understand, for example, when face-to-face meetings will be better to accomplish their purpose, whether the amount of information to be discussed actually requires such a meeting or not. All knowledge workers need to share these skills, since they are expending increasing efforts in communicative work and are required to choose among an expanding repertoire of channel options.

There is already strong social meaning attached to the computer -- positive for some, negative for many. Just as illiteracy carries a deep stigma in this literacy-based society, lack of skills in use of the computer is often a source of embarrassment and insecurity in the workplace. Implementation of electronic communication must take these social meanings into account. Some workers will respond by enthusiastically embracing the new literacy channel; they are pleased to demonstrate their new skills. Others will argue, without even trying it,

that the computer is not an aid to their work. And, just as we attach higher veracity to the written word in our culture -- we say, "I'd like to see that in print" when we really want to be sure something is true -- the level of confidence that electronic messages evoke will be a factor in communicative decision-making, varying by local standards.

Attitudes toward communication channels evolve with the technologies. The same workers who feel that electronic communication is "dehumanizing" are usually happy to interact over the telephone, yet the same dire predictions were made when the telephone was introduced. But it is now a familiar, comfortable tool. Electronic literacy is just as subject to personalization as other channels. In fact, many electronic message system users report that their writing is less formal and more individual than when they used paper and that they can get the many of the same interactive effects from using e-mail as from the oral channels, inserting jokes, irrelevancies, and allowing their informality to come through in their casual syntax and even occasional spelling errors (Strassman 1985:45).

Characteristics of Communication Channels

Each of the oral and literate communication channels has certain advantages and disadvantages for use in the automated workplace. While the functions, social meaning, and -- to a lesser degree -- technical skills for the electronic literacy channel are still so new that their manifestations are far from standardized from workplace to workplace, some general recommendations can be made about the appropriateness of each channel for specific business purposes.

Table Three compares and contrasts the communication channel choices available in the automated workplace. Several of the characteristics outlined on Table Three are primarily the concerns of planners and managers, especially the equipment required and the costs of the communication, but they must also foresee needs for storability and retrievability. In order to make good channel choices, individual workers must understand the social meanings of the channels in their place of work and they must be appreciative of how communicative norms shift with function. They must, of course, possess appropriate technical skills. For each message, workers must consider how many people need to receive the message, when they need to get it, and where they are located. Further, they must make some assessment of the type of communication that is most desirable, e.g., will one-way dissemination suit the purpose at hand or is interaction more appropriate.

Figure Three suggests how some of these channel characteristics scale with specific communication tasks. Note that more literacy-based tasks fall at the rational/low social presence end of the continuum and tasks commonly conducted orally at the feeling/high social presence end. Electronic message systems, combining as they do features of both speech and writing, may range widely over this task continuum. How electronic messages are perceived and for what purposes they are suited is still highly variable, depending on the evolving literacy practices of the specific workplace and the level to which automation has penetrated its communicative structure.

TABLE THREE: Channel Characteristics

	CHANNELS FOR LITERACY		CHANNELS FOR SPEECH	
	ELECTRONIC MESSAGE SYSTEMS (E-mail and electronic conferencing)	PAPER-BASED LITERACY (Hand-written, typed and word-processed)	TELECOMMUNICATIONS (Telephone, teleconferenc- Voice messaging)	FACE-TO-FACE INTERACTION (Conversation, meetings)
SYNCHRONICITY:	Synchronous or asynchronous	Asynchronous only	Synchronous, except voice messaging also asynchronous	Synchronous only
SPACIAL DISTRIBUTABILITY:	Instantaneously & infinitely distributable at negligible cost	Delayed distributability at cost of materials & labor for reproduction	Limited distributability at connection cost	Non-distributable
DISSEMINABILITY:	Instantaneously & infinitely disseminatable at neglible cost	Delayed disseminability at cost of materials & labor for reproduction	Non-disseminatable unless recorded	Non-disseminatable
PARTICIPATION NUMBERS:	E-mail for dyads & small groups; e-conferences for large & small groups; bulletin boards permit very large numbers asynchronously	Infinite participation possible; ranges from 2 to many	Very restricted participation; audio-conferences to approx. 5, video-conferences to approx. 15	Conversation restricted to small groups; meetings become one-way at 20+
DEGREE OF INTERACTIVITY:	E-mail often interactive; e-mail and -conferences non-interactive	Non-interactive	Interactive	Interactive; very large groups lose interactivity (e.g., lectures)
STORABILITY & RETRIEVABILITY:	Instantaneously storable at no cost; instantaneously retrievable by multiples simultaneously	Storable at cost of labor and materials; easily retrieved by individuals	Non-storable, unless recorded; very difficult to retrieve	Non-storable
MESSAGE CHARACTERISTICS:	Range from very informal to formal styles; e-mail usually short, though file material may be inserted	Hand-written may be informal; type-scripts range to very formal; length varies by function	Relatively informal	Very informal to relatively formal, depending on function
EQUIPMENT REQUIRED:	Computing equipment with messaging facilities connected as network; costs high	Writing instrument, typewriter, word-processor; reproduction equipment; costs low to high	Telephone (with VS&F for messaging); interactive telecommunications equipment; costs moderate to high	Costs none to negligible
FUNCTIONS:	Announcements, scheduling, sharing information, project co-creation of documents, record-keeping	Share information, announcements not urgent, most official documentation of company work, external correspondence (e.g., billing)	share information, external contacts; teleconferencing primarily to exchange ideas	Informational uses, but especially exchange ideas; maintain co-worker contact

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SOCIAL MEANING:	May be very impressive of efficiency; perceived social presence varies from moderate to very low, depending on recipient's experiences	Usually has formal & official connotations, hand written may be informal; low social presence; may be perceived as out-of-date	Informal usually; moderate level of social presence; telephone sometimes regarded as intrusive	Often informal, but initiation by superior may create highly formal situation; high social presence
TECHNICAL SKILLS:	Usually, keyboarding; low-level menu-user skills; need good writing & reading abilities	Writing and reading, for some media keyboarding	Speaking & listening skills	Speaking & listening skills
ADVANTAGES:	Immediate or delayed response; no costs or delays for dissemination; requires only low computer skills; may be used informally; records may be maintained; instantaneous over distance	Literacy skills are widespread; documents are storable & scannable; relatively inexpensive; portable; familiar medium	Offers some of the cues of face-to-face interaction; instantaneous over distance interactive; familiar & oral skills widespread	High level of social presence; offers many cues in nonverbal and affective behavior; oral skills widespread
DISADVANTAGES:	Costly; as yet unfamiliar; lack of visual cues may lead to misapprehension; literacy skills required	Significant costs; delay in dissemination ? distribution; literacy skills required	Varying costs; difficult to store, disseminate; lacks a level of social presence & some interactional cues	Cannot be disseminated or distributed; not storable

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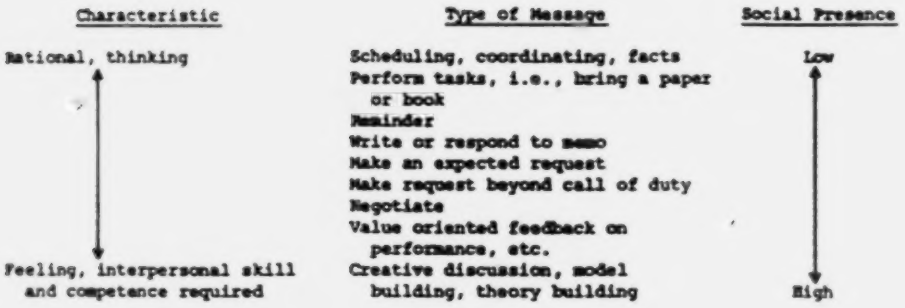
FIGURE THREE: Channel Qualities Required

for Communication Tasks



Source: Adapted from Olson and Lucas 1982:843.

Organizational Effects of Extended Literacy Practices

If the potentials of each communication channel are to be realized by an organization, traditional literacy practices and the structure of information flow must be substantially altered. Electronic communication is expected to decrease the need for face-to-face meetings between supervisors and supervisees as well as among colleagues, but, at the same time, to increase the total volume of communication amongst them (Olson and Lucas 1982:838). Effective workers, then, would reassess the frequency and nature of their meeting structure, considering the informational and morale functions such interactions have played and reassigning worthwhile functions into their new communication matrix. All communication channels, oral and literate, are affected by the introduction of electronic messaging and conferencing. Computer conference systems have been shown to reduce paper mail, but not the use of the telephone in some firms; to reduce face-to-face interaction and the telephone, but not paper documents in others (Rice 1980:237).

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It is generally anticipated that electronic communication will extend the manager's span of control, since information is readily available in full form and since direct communication throughout the organizational hierarchy and across spacial distance is easy and frequent (Olson and Lucas 1982:842, Rice 1980:225). Indeed, there are indications that entire levels of organizational structure, for example, floor foremen and middle managers, can be eliminated through automation of information processing and communication (Williams 1983). The impact on public and private sector employees should be profound.

These changes can best be affected by an organization after it has conducted a thorough analysis of its communicative norms and structure. It is not sufficient to consider just the formal communications -- the memos, files transfer, documents produced, and scheduled meetings that take place (as is common in workplace communication studies, e.g., Miller 1982). Though unrecognized in most job descriptions and underestimated by workers themselves (Conklin and Reder 1984, Poppel 1982), communication work is an ongoing activity among knowledge workers. Exchange of short, informal electronic messages and brief, unscheduled conversations are just as crucial to productivity as many documented exchanges of information. The full realization of the potential of the new electronic literacy channel will depend on workers' abilities to understand and make use of its new tools, but it will depend equally on management's willingness to carefully assess the communicative work of the organization and to adapt the organization to the new technologies.

LITERACY TRAINING FOR WORKPLACE AUTOMATION

> Training, training, training: these are the top three priorities to changing work in the automated office.
> -- Paul A. Strassmann

Training for Functional Competence

Most training for employees in automated workplaces is directed toward learning to use specific equipment their employer has installed, or which they are expected to encounter once on the job. Much of this training is provided by vendors; it is not designed to instill adaptability in employees. Rarely is training tailored to the individual company's informational and communicative environment. Just how the new technologies are to fit into the existing flow of work and communication is left to happenstance and the creativity of the workers themselves.

Generally, instruction is limited to applications most critical for the specific task accomplishments found in the employee's job description or the department's workplan. Since communication rarely appears in job descriptions -- not even those of managerial workers, for whom it is the primary activity in which they expend effort -- it is seldom a focus for worker automation training.

Training in computer use -- on-the-job, in pre-employment programs, and in secondary schools -- is, as we have seen above, widely regarded as a problem of human-machine communication. Yet the cadre of professionals who actually do programming work remains very small and the number who use computers as data and information processing tools is being eclipsed by the far vaster number who will find themselves using the computer primarily for communication purposes.

These workers -- and they appear in all job categories -- constitute an unmet training need. They will be engaged, not in human-machine communication, but in human-human communication, using computer-based messaging and conferencing systems as one of the channels among which they must choose. Their ability to select wisely among the expanding array of communication channels will increasingly determine the accuracy and efficiency of task accomplishment in the automated workplace.

The paragraphs which follow suggest how employers and secondary teachers might pursue development of programs for training in functional literacy for the automated workplace. Following the model of functional literacy outlined in the preceding section, on-the-job trainers should consider how to work with existing employees to create a model of the communicative structure of their workplace which can be used to orient new workers and to assess the effects of changes in information and communication technologies and procedures before or as they occur.

Secondary teachers may wish to integrate the skills and activities suggested here into business education courses or, even more appropriately, into the general language arts curriculum. These activities, directed toward expansion of literacy and analytic skills, are congruent with the emphasis on basic verbal skills development at the heart of the contemporary movement for school improvement.

Functional Literacy Skills

There have been a number of attempts in recent years to delineate the responsibilities of the schools for preparing youth to enter the information economy. The Education Commission of the States stressed "learning-to-learn" skills and basic competencies (Reported in Crohn 1983:15, 53-55). Relevant to the themes here, this report cites the need

to be able to "recognize different purposes and methods of writing", though stopping short of realizing the importance of communication channel. A National Academy of Sciences, National Academy of Engineering, and Institute of Medicine survey of employers produced a list of "core competencies" required of high school graduates, including reading, writing, and oral communication skills (Panel on Secondary School Education for the Changing Workplace 1984:20-27). The required competencies are strongly oriented toward developing students' abilities to independently recognize, analyze, and solve problems. Literacy skills specified include awareness of inconsistencies, understanding the purpose of written materials, verifying and evaluating information, organizing and interpeting qualitative and quantitative information, and obtaining information through intelligent questioning.

Beyond the basic communication skills that these task forces have outlined, there are specific functional literacy skills that effective knowledge workers will need to command. In addition to specific competencies, they will need the analytic ability to understand the social meanings attached to the communication channels in use in their place of work.

Keyboarding. Every student, regardless of career aspiration, should acquire good keyboarding skills; typing is necessary for accessing many of the communication and information channels in the automated office. While voice messaging may become more widely used it will not replace electronic mail. The oral medium is simply too restrictive to handle all the types and lengths of messages that are sent for asynchronous receipt.

File systems. In an automated workplace each employee creates and maintains a personal file system. Everyone needs to understand the

principles of file system development. In some circumstances others will need to access these files and they must be readily comprehensible. Further, some files are widely shared and their construction should be consistent and coherent thoughout the work group. Such fine points as naming conventions become crucial elements in effective work. Remember, information is the product in this new economy; the files are its repository.

Editing, proofreading, spelling, reference. While electronic spelling checkers are widely used and grammar checkers are on the horizon, they will not suffice to assure accurate, stylistically correct documents. Some electronic mail messages are extremely informal, but others constitute formal archival records of company work. Many professionals and managers accustomed to relying on clericals for such fine tuning of their documents will be thrown back on their own literacy resources as staffing is restructured to exploit new communication technologies.

Reading of non-print images. There is a psychological and perceptual adjustment required to use video display screens instead of paper. A radically different strategy for scanning electronic documents must be mastered. Also, graphic materials may be more widely used and must be comprehended as readily as alphabetic docments. Workers should not prematurely create paper copies of draft materials, wasting time and resources and, perhaps, fixing a document's form before it is completely worked through.

Message composition. Electronic messages have been found to be less concise and clear than texts written on paper, especially among new computer users. There are composition skills and styles that are

specific to electronic communication, just as there is a writing style characteristic of telegraphy. The electronic channel permits a great deal of informality, but workers must also be capable of producing well constructed reports, memos, and letters. This becomes all the more crucial when electronic mail and conferencing are the primary channels for interaction among workers collaborating on a project from remote sites.

Full repertoire of written styles. While most of us command a wide range of oral styles, for instance sensing if it is appropriate to interrupt a conversation to tell a joke or when to strike an intimate or deferential tone, many workers have more limited experience initiating interaction through written media. When conducting business remotely, employees lack the visual cues apparent in face-to-face interaction and the intonational cues that even the telephone transmits. Careful judgement in style and tone of communications will be critical to interactional success. Furthermore, fewer workers will have clerical assistance directly at hand, so their documents will go out without external editing for stylistic appropriateness or congruence.

Collaborative writing. Automation will increase, not decrease, cooperative work. Electronic messaging and conferencing permits drafts of documents to be circulated quickly and widely for comment and revision. Such collaborative work requires clear and accurate writing and also careful, analytic reading skills. Workers must be able to state their ideas clearly, comprehend others' ideas quickly, criticize without being negative or personalistic, and integrate others' comments (both substantial and stylistic) into their documents.

Strategic planning of communication work. It is of paramount importance that workers understand the general and individual communicative norms of their work environment, e.g., how appropriate is it to send a particular message to a specific department or person via the various channels, and the information structure of their workplace, e.g., if a message is sent via this or that channel what will be its impact, its priority, its turn-around time. Communication tasks are complex and time-consuming; workers must learn to schedule their communication work, appreciate the time it takes, and prioritize communication tasks among their other work activities.

Topics for Functional Literacy Training

The topics and activities suggested here may be adapted to the specific workplace in which on-the-job training is taking place, using, for example, documents that have been produced in the trainees' departments or in a department that is regarded as a model for communicational efficiency (or lack thereof). School teachers may wish to obtain samples from local firms to bring into their classes; they may also wish to invite representatives from local firms to respond to some of the areas of discussion presented here.

Genres of business writing.

- Using examples of actual documents, develop functional descriptions of the types of written materials that workers will encounter. Consider to whom, for what purpose, and through which channels they should be sent. What, for example, is the functions of a memo -- within a department, between departments, up or down the hierarchy? To whom is it appropriate for different classes of employees to direct a memo? For what functions is a memo appropriate, required, too formal, too informal? Who can or should be "copied"? Can memos be sent through electronic mail -- if so, to what effect? How about a letter -- are letters only for out-of-company communications? What are the common functions for which employees use e-mail? A hand-written note? A yellow "post-a-note" stuck on a chair?

- Discuss what sort of writing style is appropriate for the different genres. Again, example documents -- good and bad -- can be used. Consider terms of address, word choice, carefulness in spelling and grammar. Do these responses vary by recipient, by purpose of the communication, by department, and, especially, by the channel being used?

- Employees in automated offices are independently responsible for conducting and documenting much of their work. Discuss electronic and paper filing and recordkeeping. Some good examples of personal and departmental electronic files might be examined; through a series of trainings a model of the company's overall record system can be developed. Trainees might need to consider what of their work and the mail that crosses their desks or video screens they should archive, what they should circulate, and in which forms.

Choosing a communication channel.

- If you have electronic messaging equipment, have trainees try out the effects of the different channels by using handwritten, typed paper, and electronic means of sending and receiving writng samples. Examine the effects of trying to read, e.g., a highly technical report or a very long document via a video screen. Consider whether the difficulties lie in the medium, or in the construction of the particular document.

- Have trainees practice writing mechanically and electronically. The goal here is to get them to understand the advantages of text editing and word processing capabilities of their equipment and the ways in which the writing process is effected. Note that the facilities of word processors that make changes so easy can sometimes make a document seem never to be finished. How can workers decide when a document is "good enough"? What constitutes final form in each medium? Explore the appropriateness of each literacy channel for various genres of business messages.

- Compare and contrast the oral and written channels available in the automated workplace. What are the advantages of each channel: for what contexts, what purposes? What do you learn from face-to-face conversation or on the phone that is missing in elecronic messages or in paper documents? How can these losses be compensated? On what occasions are the extra behavioral cues so important that face-to-face is called for? Bring some of the information on functional literacy and channel choice from the preceding section to the attention of the trainees and discuss how our associations with print and with spoken language affect our use and comprehension of messages.

- Conduct an analysis of the efficiency benefits of different channels. This could include a cost analysis -- what is the expense, in labor and in production costs, of sending a document via e-mail, hard copy from a word processor, hand drafted? What about the use of central word processing vs. doing your editing

yourself? Also consider time: what is the delivery and turn-around time for paper intra- and inter-office mail, for reproduction via the central word processing center, for e-mail sent directly, for reaching someone on the phone? Investigation of these questions would be beneficial to any firm. A study of a local firm might be an educational project for students planning to enter the workforce.

- Attitudinal variables are extremely important in channel selection. What does e-mail "mean" in your firm? Is it an informal medium, used casually among co-workers, or is it more frequently used for official actions between managers to supervisees? Is hard copy so rare that its appearance is associated with management directives? Or is use of paper construed as "old fashioned"? There are a wide range of aspects to consider. Employees will have opinions about the meanings of the different channels -- solicit and discuss them, especially inconsistencies among different departments. This would also be the place to discuss anxieties trainees might harbor about the new channels and to be sure that they do not lack technical skills that would stand in the way of effective use of all channels.

Analyzing communicative structure.

- With the trainees, develop a model of the communicative structure of your organization. Students could develop one of their school or some other large organization in which they are involved, or visit a firm to see first-hand how it works there. Questions to consider would include: How do new workers learn "the way we do things around here"? What are the mistakes that newcomers make -- either in doing something in a less efficient fashion or making a social faux pas by communicating through the wrong channel or in the wrong style? Who are the "good communicators" in your group and why do people think so? (These people are usually widely agreed upon; consider bringing them, or their insights, into the training.) Use trainees' personal experiences of times that communication was good and bad to find the outlines of your communication structure and social norms for channel use. The network for communication may not parallel the official organizational chart; consider why not and what that might mean for changes to come from automation. What are the communication bottlenecks in the organization and how can they be recognized; would new communication technologies help, if those individuals or departments were to implement them?

- Have trainees consider their own communication work. How much time do they spend on what channels and why are those preferred? How did they learn to work the way they do? Is communication in their job descriptions; if not, how would they redescribe their job? How do workers organize their time to do their communication work most efficiently, e.g., saving up all e-mail responses for a certain period, doing their own editing. What tools would enhance their work? How do trainees conduct business with co-workers who are not on-line?

- Given the increasing volume of information, especially at higher levels in an organization, how do trainees prioritize among communications? This topic should be of particular interest to managerial and professional employees. The group might discuss their experiences with new communication channels, e.g., information they have gotten from network bulletin boards, new corporate-wide communication support facilities that compensate for lost secretaries.

Training Delivery Models

Adaquate preparation of the labor force for workplace automation is a common interest of educators and employers. However, training for automation is intrinsically difficult for the schools, since the technology available to educational institutions lags far behind the state-of-the-art. Furthermore, teachers -- those who must do the training -- rarely have a first-hand familiarity with the automated workplace. Although many teachers are learning about use of computers for word processing or perhaps accessing electronic bulletin boards, few have had the opportunity to experience environments in which the computer is regularly used as the channel for accomplishing group work.

Several strategies have emerged to facilitate employer-educator cooperation, exposing teachers and students to communication technologies as they actually function in automated workplaces:

Teacher internships. Some corporations have begun sponsoring summer internships for business, vocational, and basic skills teachers in their local schools. The teachers receive first-hand knowledge of how the automated office works. Teacher-interns can also participate in on-the-job training courses.

Telecommunicating. Rather than actually locating physically in automated firms, teachers (and students) can participate in the workplace from their homes or classrooms via electronic mail and conferences.

Paired with corporate mentors, teachers can be given a regular staff assignment, as though they were a conventional intern, and "telecommute". This strategy would also work to extend a brief on-site internship program. If the teacher participates in the workplace from an in-school computer, students, too, can observe how the new communication channels are actually put to use.

Student visits, internships, and projects. Students can undertake some of the analyses of office communication that have been suggested above, visiting local businesses and observing and interviewing employees. In some firms high school students are invited to try out careers in fields such as word processsing through after-school work placements in functioning communications centers. Students contemplating job entry can also be invited to on-the-job training where they can work hands-on with the new equipment. Or, as a second choice, experienced on-the-job trainers can visit school classes.

Developing curriculum plans and materials. In some states businesses and public agencies are working with the schools to develop curriculum on office automation skills by providing expert assistance to planners and by lending sample documents to curriculum developers.

Simulation training. Teachers might particpate as "workers" in a simulated automated office, communicating with other teacher-"workers" on specified information and data processing tasks via a computer network. One simulated corporation, developed and run by educational researchers, offers participants opportunities to use electronic mail and conferencing to accomplish given work related to their own jobs, e.g., developing curriculum on communication technology training for their districts. The ongoing electronic conference is supplemented by periodic face-to-face

workshops at which participants and corporate mentors discuss what they have learned about the new communication channels. Such simulation training might eventually be extended to students.

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